Determination of the Diameter and Compression of the Planet Mars from Observations with the Repsold Heliometer of the Royal Observatory, Göttingen. (Second Communication.)

By Professor W. Schur.

Near the opposition of the present year the following measurements of the polar and equatorial diameters of the planet *Mars* were made, the images being steady :—

Date, 1899.	Mean Time, Göttingen. h m	Areographic Latitude. °	Measured Diameter. ″		Diameter at Mean Distance from the Sun. ″	Mean of *h* and *v*. ″
January 21	8 44	90	14·74	*h*	6·33	6·23
			14·50	*v*	6·23	
		0	14·62	*h*	6·28	6·34
			14·90	*v*	6·40	
		0	14·63	*v*	6·29	6·28
			14·59	*h*	6·27	
		90	14·33	*v*	6·16	6·18
			14·43	*h*	6·20	
		90	14·52	*h*	6·24	6·38
			15·15	*v*	6·51	
		0	14·40	*h*	6·19	6·40
			15·36	*v*	6·60	
		0	15·41	*v*	6·62	6·46
			14·63	*h*	6·29	
		90	14·75	*v*	6·34	6·26
			14·36	*h*	6·17	
January 23	13 15	90	14·59	*h*	6·30	6·24
			14·28	*v*	6·17	
		0	14·24	*h*	6·15	6·22
			14·56	*v*	6·29	
		0	14·21	*v*	6·14	6 21
			14·51	*h*	6·27	
		90	13·87	*v*	5·99	6·05
			14·12	*h*	6·10	
		90	13·87	*h*	5·99	6·07
			14·23	*v*	6·14	
		0	14·23	*h*	6·14	6·17
			14·36	*v*	6·20	
		0	14·26	*v*	6·16	6·14
			14·14	*h*	6·11	

Date, 1899.	Mean Time, Göttingen. h m	Areographic Latitude. °	Measured Diameter.		Diameter at Mean Distance from the Sun.	Mean of *h* and *v*.
			″		″	″
January 23	13 15	90	13·90	*v*	6·00	5·97
			13·76	*h*	5·94	
January 26	12 19	90	14·01	*h*	6·11	6·13
			14·07	*v*	6·14	
		0	14·35	*h*	6·26	6·30
			14·53	*v*	6·34	
		0	14·34	*v*	6·25	6·22
			14·17	*h*	6·18	
		90	14·05	*v*	6·13	6·17
			14·23	*h*	6·20	
		90	13·96	*h*	6·09	6·11
			14·03	*v*	6·12	
		0	14·30	*h*	6·24	6·32
			14·65	*v*	6·39	
		0	14·41	*v*	6·28	6·30
			14·47	*h*	6·31	
		90	14·16	*v*	6·17	6·17
			14·14	*h*	6·17	

As in the former communication (*Monthly Notices*, 1897, January), *h* and *v* denote the measurements with apparent horizontal and vertical motion of the images by means of the ocular reversing prism. The small correction for defect of illumination is taken from the ephemeris of Mr. Crommelin in the *Monthly Notices*. On January 21 in the second part the images were sometimes a little unsteady and blurred; hence the larger discrepancies.

If the results obtained 1896 December are combined with those of the present year, we have the following summary, including some small later corrections :—

		$2a$.	$2b$.	Diff.	$a=\frac{a-b}{a}$	
		″	″	″		
1896 Dec.	2	6·265	6·125	0·140	1 : 45	
	11	6·310	6·135	0·175	36	Opposition Dec. 10.
	16	6·210	6·095	0·115	54	
	17	6·235	6·125	0·110	57	
1899 Jan.	21	6·370	6·263	0·107	60	
	23	6·185	6·082	0·103	60	Opposition Jan. 18.
	26	6·285	6·145	0·140	45	

The observations of the present year confirm those of 1896, and the planet would therefore have a compression of a fiftieth.

This result is to be preferred to that of earlier researches which have in part led to a similar value, since in the recent observations the use of an ocular reversing prism eliminates those peculiarities of the eyes of the observers which give rise to different results in measuring diameters of discs in different directions with the vertical line. The results of observations with the Göttingen heliometer have therefore a greater weight. (Compare the exhaustive researches of E. Hartwig, *Publication der Astronomischen Gesellschaft*, vol. xv.)

The result of the Göttingen heliometer observations is in conflict with that which Hermann Struve has calculated from his researches on the motions of the apsides of the satellites *Phobos* and *Deimos* (*Astronomische Nachrichten*, vol. cxxxviii, p. 228), *i.e.* $\frac{1}{190}$. One might be inclined to prefer the result of Struve, as there the compression is deduced from the perturbations in the motions of the satellites, but it should be remembered that the measured positions of the satellites, referred to the centre of the planet, are likewise founded upon comparisons with different points in the circumference of the disc, and that therefore errors may arise similar to those occurring in the heliometer observations. Respecting the latter, I must remark that in the opposition of this year the northern polar snow cap was visible in considerable extension and intensity, and that therefore the measurements of the polar diameter were rather difficult. But, as Hartwig has already shown on p. 54 of his treatise, this disturbing influence would not act in such a way as to diminish the polar diameters, but, on the contrary, to enlarge them, and therefore could not explain that difference.

In a recent publication (*Annals of the Lowell Observatory*, vol. i., "Observations of the Planet Mars during the Opposition of 1894–95," p. 75), Mr. Percival Lowell finds a value for the compression in good accordance with H. Struve, *i.e.* $\frac{1}{190}$; but it is not shown whether these observations are independent of errors in estimation—which in the case of the Göttingen heliometer measures are provided against by the use of the ocular prism—and I am of opinion that in all researches relating to the form of a celestial body this point is a necessary condition.

To reduce the diameters to the mean distance between Sun and Earth, the foregoing values of $2a$ and $2b$ are to be multiplied by 1·5227, and we have :—

$$2a = 9''{\cdot}55 \qquad 2b = 9''{\cdot}35.$$

Or, if we decline to adopt the great value of compression, the mean diameter of the planet *Mars* is $9''{\cdot}45$.

It is to be hoped that observers with other heliometers have taken the opportunity to contribute to the settlement of this question.

1899 *February.*

The Radiant Point of the April Meteors (Lyrids).

By W. F. Denning.

On Wednesday morning, 1803 April 20,* a brilliant meteoric shower was observed from Richmond, Va., Raleigh, N.C., Wilmington, Del., Schoharie County, N.Y., Portsmouth, N.H., and at several places in Massachusetts. The phenomenon was variously described according to the different impressions received by the observers. One said "the shooting stars were too numerous to be counted"; another stated that "the heavens seemed to be all on fire from the abundance of lucid meteors." The *Virginia Gazette* in alluding to the event said that "from one to three in the morning meteors seemed to fall from every point in the heavens, in such numbers as to resemble a shower of sky-rockets. The inhabitants happened at the same hour to be called from their houses by the fire bell, which was rung on account of a fire which broke out at the Armoury, so that everyone had an opportunity of witnessing this grand scene of Nature."

In 1838 April 20 Professor Wright and an assistant at Knoxville, Ten., counted 154 shooting stars between 10^h and 16^h. In 1839 April 18 Herrick watched for the return of the shower, and in the three hours following midnight he and another observer counted 58 meteors. Herrick placed the radiant at 273°+45° between *Lyra* and the head of *Draco*. In 1842 April 20 he re-observed the shower, and in spite of moonlight 151 meteors were seen by five observers between $10^h\ 20^m$ and 16^h. The maximum hourly rate was 55 between 15^h and 16^h, and the

* Ancient showers, probably of Lyrids, are mentioned by Biot, Chasles and Herrick. They have been summarised by Professor H. A. Newton in the *American Journal of Science and Art*, vol. xxxvi., p. 145, and he points out that the time of occurrence of the shower has advanced 24 hours in 60 years, owing to the precession of the equinoxes. The dates and corresponding modern epochs of the ancient displays are as follows:—

Authority.	Date.						
Biot	B.C. 687	March	16	equivalent to	A.D. 1850	April	19·9
Biot	,, 15	,,	25	,,	,,	,,	19·6
Chasles	A.D. 582	,,	31	,,	,,	,,	18·1
Chasles	,, 1093	April	9·6	,,	,,	,,	20·7
Chasles	,, 1094	,,	10	,,	,,	,,	20·8
Herrick	,, 1095	,,	9·6	,,	,,	,,	20·2
Herrick	,, 1096	,,	10	,,	,,	,,	21·3
Herrick	,, 1122	,,	10·6	,,	,,	,,	20·2
Chasles	,, 1123	,,	11	,,	,,	,,	20·4
				Mean date .	.	1850 April	20·1

The conformity of dates renders it extremely probable that the old observations refer to veritable returns of the Lyrids.